Procedures and Guidelines (PG)

DIRECTIVE NO.	740-PG-7120.7.4	**APPROVED BY Signature:**	*Dennis Vander Tuig*
EFFECTIVE DATE:	January 23, 2014	**NAME:**	Dennis Vander Tuig
EXPIRATION DATE:	January 23, 2019	**TITLE:**	Chief Information Officer (Acting)

COMPLIANCE IS MANDATORY

Responsible Office: Code 740 / Program Integration & Management Division (PIMD)

Title: Requirements Management Procedural Guidance (RQM PG)

PREFACE

P.1 PURPOSE

This procedural guidance (PG) establishes standardized best practices for Requirements Management (RQM) for all organizations, services, activities, programs and/or projects within Information Technology & Communication Directorate (ITCD).

Requirements are the foundation of any effort. They form the basis for delivery, for design, for development, for testing and ultimately for operations and maintenance. Every requirement has a cost impact on the effort – that is why a complete set of requirements must be established early in the effort's lifecycle. Changes to requirements later on can have significant cost impact to the effort and must be managed effectively.

This RQM PG has several purposes:

- Specifies the procedures a project, program, or organization shall follow when performing RQM;
- Identifies the roles and responsibilities for stakeholders involved in the RQM process;
- Outlines how the RQM activities will be performed, recorded, and monitored;
- Documents how and when requirements are communicated and how conflicts over requirements are resolved; and,
- Identifies the tools and techniques that will be used by the organization, Program or Project Manager (PM), assigned lead, and team members.

This document, and the RQM practices contained within, shall be adopted using one of the following approaches:

- Report the adoption of this RQM PG in its entirety via a reference within the documented Project Plan (PP) for the effort; or,
- Create an organization, program, or project-specific Requirements Management Plan (RQMP) using the Project Management Office (PMO) approved template to document how the organization, program, or project is adopting this RQMP in its entirety, and declaring any exceptions.

Organizations, programs and projects may seek tailoring approval or waiver requests from specific RQM practices contained within this PG, based on specific documented constraints or requirements. These requests will be considered on a case-by-case basis by the IT Project Management Office (PMO).

The PMO is a dynamic organization within ITCD, sponsored and managed by the Program Integration and Management Division (PIMD). PIMD is engaged in transforming into an IT Project Management center of excellence that will deliver results that enable mission success. PIMD is tasked with improving the delivery of IT services and solutions to ITCD customers, better enabling executive decision-making, instituting a professional development framework, and improving organization alignment and coordination.

This PG can be adopted for use by other organizations following the process identified in Goddard Procedural Requirement (GPR) 1410.1G, Directives Management.

P.2 APPLICABILITY

This procedural guidance shall apply to all organizations, services, activities, programs and/or projects within ITCD.

Given this PG was developed using best practices for requirements management, any Goddard IT project required to follow NPR 7120.7 and/or 7150.2A can opt to use these requirements management processes to manage IT projects' requirements.

P.3 AUTHORITY

a. NPR 7150.2A, NASA Software Engineering Requirements
b. NPR 7120.7, IT & Institutional Infrastructure Program and Project Management Requirements

P.4 REFERENCES

NASA resources used in the development of this PG include, but are not limited to:

NASA Document	Title
740-PG-7120.7.2A	Information Technology (IT) Project Management Lifecycle Process
740-TMP_1-2-12	Requirements Review Presentation Template
Code 580_PA2.2.2	Requirements Management
Code 580_PA2.2.1.3	Requirements Traceability Matrix Guidelines
NHBK SP 2007-6105	Systems Engineering Handbook, Revision 1

Industry resources also used in the development of this PG include:

a. Project Management Institute (PMI) Project Management Book of Knowledge (PMBOK, 5th edition): Requirements Management
b. Carnegie Mellon's Software Engineering Institute (SEI) Capability Maturity Model Integration – Service (CMMI-Svc), Version 1.3: Requirements Management
c. International Institute of Business Analysis (IIBA), Business Analysis Body of Knowledge (BABOK)

P.5 CANCELATION

None.

P.6 SAFETY

None.

P.7 TRAINING

Training on the contents of this PG is provided by PIMD.

There are many RQM training courses currently available via the System for Administration, Training and Educational Resources for NASA (SATERN), including but not limited to:

- Business Analysis: Requirements Management and Communication
- Business Analysis: Introduction to Requirements Analysis
- Business Analysis: Solution Assessment and Validation
- Business Analysis: Verify and Validate Requirements
- Business Analysis: Requirements Elicitation

P.8 RECORDS

The following records are produced by the RQM efforts and shall be retained by the IT Project in accordance with NASA records retention policies:

Record Title	Record Custodian	Retention
Completed Requirements Review presentation(s) and related materials such as: meeting minutes, action items	Performing Organization	*NRRS 8/107: for program/project records having operational value to the Agency throughout the program/project life. Temporary. Destroy/delete between 5 and 30 years after program/project termination.
Completed requirements documentation including, but not limited to: Requirement Traceability Matrix (RTM), System Requirements Specifications (SRSs), Functional Requirements Documents (FRDs), or other applicable documentation that captures and records approved and baselined requirements for an effort.		

** NRRS – NASA Records Retention Schedule (NPR 1441.1)*

Official records for ITCD requirements management shall be stored on the ITCD SharePoint portal and retained in accordance with NASA records retention requirements.

P.9 MEASUREMENT/VERIFICATION

ITCD organizations, services, activities, programs and/or projects shall collect and be able to accurately report upon the following metrics for the effort:

- Number of original requirements;
- Current status of each requirement (i.e., approved, rejected, deleted, on hold, planned for future release, etc.);
- Number of requirements added to date; and
- Degree of compliance to approved requirements;
- Relationship among requirements;
- Percentage of requirements changed to date.

ITCD organizations, services, activities, programs and/or projects shall be capable of reporting status of requirements management activities and deliverables upon request.

ITCD organizations, services, activities, programs and/or projects shall provide documented copies of requirement management records upon request of the Responsible Management Official (RMO), the IT PMO, or other ITCD leadership or sponsoring organization(s).

P.10 DOCUMENT STANDARDS

In this document, a requirement is identified by "shall", a good practice by "should", permission by "may" or "can", expectation by "will", and descriptive material by "is."

Additionally, the first use of any RQM-specific term or acronym has been identified using the convention of bold and italicized font-face text (i.e., "***Requirements Management***").

Also in this document, the term "*effort*" is used synonymously to reflect ITCD's services, activities, programs and/or projects (the terms "services, activities, and projects" are defined in GPR 2800.2).

The terms "*Organization, Program or Project Manager, or Assigned Lead*" are used to describe the appropriate party that is responsible for the overall success and execution of a given ITCD effort.

The terms "*System, Solution, Products, or Services*" are used synonymously to describe the final deliverable that fulfills the business needs and achieves the overall objectives of a given ITCD effort.

PROCEDURES

1 REQUIREMENTS MANAGEMENT OVERVIEW

1.1 GOAL OF REQUIREMENTS MANAGEMENT

Requirements Management (RQM) is a discipline that defines how requirements will be analyzed, documented, and managed. RQM involves processes that create a current, correct, and under control set of documented and common understandings of customer's needs, intended product use, development resources, constraints, and needed capabilities that are captured and baselined in requirements documentation.

RQM enables the management of an effort's requirements as they relate to the system, solution, products, or services that will be delivered, and the verification of consistency between those requirements and the effort's work products or deliverables.

RQM oversees all of the requirements of the effort documented in any agreement and related documents (i.e., the Statement of Work) including those generated during requirements gathering and analysis or decomposition. As a result, RQM includes both the technical and non-technical requirements of the effort including requirements for the overall management and product delivery.

The result of this process is an updated and organized set of documented requirements throughout an ITCD effort's life-cycle that:

- Support the customer's needs, goals, and objectives;
- Remain within a well-defined scope;
- Support tracking and recording of costs and efforts;
- Align with design and subsequent testing efforts;
- Identify current resources and constraints; and,
- Identify and quantify impacts of changes including those of: scope, schedule, cost, hardware/software, and staffing.

Prioritization and acceptance of the effort's requirements are determined as an outcome of the formal review

1.2 REQUIREMENTS MANAGEMENT CONCEPTS

The Requirements Management (RQM) process is integrated with almost all other aspects of the project management lifecycle. For example, RQM relies upon the effort's documented and approved scope to allow the effort to bound requirements gathering and manage the requirements so the effort stays in-scope. When changes are approved, the RQM process needs to use and conform to the ITCD Configuration Management (CM) processes, procedures, and controls in place. Furthermore, any potential changes to approved requirements need to be assessed for inherent risk using the ITCD Risk

Management (RM) processes, procedures, and plans to ensure that the proposed changes will not introduce additional risk to the effort without a commensurate plan for handling that risk.

Additionally, the RQM discipline needs to leverage the appropriate communication channels identified in the effort's Stakeholder Management (STK) plan so that the effort will effectively secure stakeholders' participation in activities such as requirements gathering, review, and approval.

Requirements provide valuable information that supports design efforts and the stakeholders' validation and verification to ensure that the requirements are correct and have been satisfied. In addition, execution of the RQM processes can generate data, measures, and metrics that should be used to monitor and control an effort's performance.

The graphic that follows depicts the many inter-relationships of RQM to other project management disciplines.

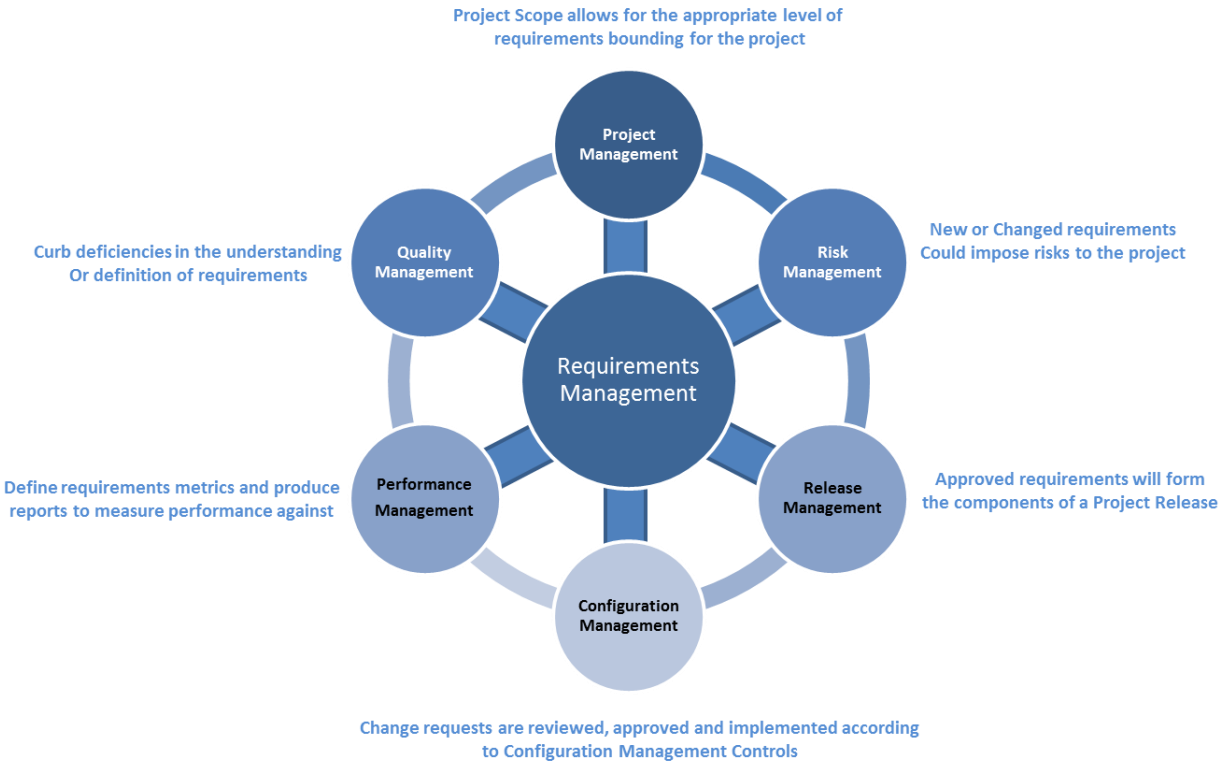


Figure 1: RQM Correlates & Integrates Across Many Project Management Processes

RQM processes ensure that:

- Requirements as-stated are accurate, correct, and approved for use in product development
- Final product conforms to approved requirements as confirmed through validation and verification

RQM addresses where requirements come from (the source of each requirement), defines the individuals and organizations that designated and authorized to create, revise, update or delete requirements for an effort and the system, solution, products, or services that will be developed as a result. RQM also establishes the plans, processes, and procedures for how requirements will be defined or decomposed, documented, approved, managed and controlled throughout an effort's full lifecycle.

RQM establishes standardized practices for ***Requirement Levels*** and ***Requirement Prioritization*** and seeks to ensure that each requirement meets quality criteria and is: ***Correct, Unambiguous, Complete, Consistent, Prioritized*** (or ranked)***, Verifiable, Modifiable/Modular,*** and ***Traceable.***

RQM provides insight into how the approved requirements are ultimately fulfilled by the delivered system, solution, product, or service; this is done using ***Bidirectional Traceability***.

1.2.1 RQM Lifecycle Overview

The RQM lifecycle is a collection of iterative processes used throughout the requirements gathering process and involves planning, collection & identification, documentation & approval, validation & verification, and monitoring and controlling of requirements. These processes entail:

1. **Requirements Management Planning** – the process to define how requirements-related activities will be planned, tracked, and monitored.

2. **Requirements Collection & Identification –** the process to determine, document, and manage stakeholder needs and requirements to meet the effort's objectives.

3. **Requirements Documentation & Approval –** the process to collect and/or create and document a set of requirements that is understood by the effort's stakeholder groups, and approved by the relevant authorized parties.

4. **Requirements Validation & Verification –** the process to ensure the requirements are meeting the intended need, have been fully addressed in design and development, meet all pertinent standards, and have the support of the sponsor and the user community.

5. **Requirements Management & Control –** the process to baseline, manage, and control requirements**.**

1.2.2 RQM Stakeholders, Roles & Responsibilities

The table that follows provides an overview of key roles and responsibilities for RQM stakeholders:

Table 1: Requirements Management Stakeholders Roles & Responsibilities

Stakeholder Roles	Responsibilities
Organization, Program or Project Manager, or Assigned Lead	✓ Identifies and communicates to the effort's team those individuals, roles, and organizations that are authorized and approved to provide requirements to the project; ✓ Identifies and communicates to effort's team the individual, role, or organization that has final decisional authority for prioritizing, accepting, approving changes to, and resolving conflict or inconsistencies between requirements; ✓ Incorporates all RQM planning information provided into applicable management-level plans including the effort's schedule; ✓ Reports RQM activities, and reports RQM activities' measures and metrics for the effort; ✓ Defines and documents evaluation and acceptance criteria for the effort's requirements; ✓ Defines and documents the requirements review and approval process for the effort; ✓ Identifies and establishes tools to be used by the effort for requirements management; ✓ Identifies the requirements management deliverables or work products that will be produced and maintained by the effort; ✓ Establishes and maintains an accurate Requirements Traceability Matrix (RTM) for the effort; ✓ Captures and records any notes, comments, or clarifications for the effort's documented requirements; ✓ Defines and documents traceability between all requirements for consideration during change management and requirements allocation; ✓ Records new/revised source documentation, requirements changes (including reasons for proposed changes), and authorized dispensation of those requirements using the RTM ✓ Maintains bidirectional requirements traceability between a requirement and its derived requirements to its allocation of functions, objects, people, processes, and work products ✓ Completes the Systems Requirement Specification (SRS) by adding appropriate content for each section of the template, based upon the effort's requirements and the effort's understanding of those requirements ✓ Conducts peer review(s) of the SRS with the appropriate stakeholders ✓ Reviews and approves effort's requirements

Table 1: Requirements Management Stakeholders Roles & Responsibilities

Stakeholder Roles	Responsibilities
Requirements Manager *	✓ Documents the individuals, roles, and organizations that are authorized and approved to provide requirements to the effort ✓ Documents the individual, role, or organization that has final decisional authority for prioritizing, accepting, approving changes to, and resolving conflict or inconsistencies between requirements; ✓ Provides RQM planning information for incorporation into applicable management-level plans including the effort's schedule ✓ Provides status of RQM activities and reports on RQM activities' measures and metrics ✓ Documents evaluation and acceptance criteria for the effort's requirements ✓ Documents the requirements review and approval process ✓ Customizes tools to be used by the effort for requirements management ✓ Produces the deliverables or work products required for RQM; ✓ Captures and records any notes, comments, or clarifications for the documented requirements; ✓ Defines and documents traceability between all requirements for consideration during change management and requirements allocation ✓ Manages the RTM using the version history and change tracking tab to record new/revised source documentation, requirements changes (reasons), and authorized dispensation of those requirements ✓ Maintains bidirectional requirements traceability between a requirement and its derived requirements including its allocation of functions, objects, people, processes, and work products ✓ Conducts peer review(s) of the SRS with the appropriate stakeholders

Table 1: Requirements Management Stakeholders Roles & Responsibilities

Stakeholder Roles	Responsibilities
Team Member(s)	✓ Participates in RQM activities, as assigned ✓ Complies with evaluation and acceptance criteria for requirements; ✓ Complies with the requirements review and approval process; ✓ Uses authorized/approved tools for requirements management; ✓ Produces the deliverables or work products that will be developed and maintained by requirements management; ✓ Collaborates with individuals, roles, and organizations that are authorized and approved to provide requirements to the effort; ✓ Captures any notes, comments, or clarifications for the documented requirements; ✓ Defines and documents traceability between all requirements for consideration during change management and requirements allocation; ✓ Manages the RTM using the version history and change tracking tab to record new/revised source documentation, requirements changes (reasons), and Customer dispensation of those requirements; ✓ Maintains bidirectional requirements traceability between a requirement and its allocation of functions, objects, people, processes, and work products; ✓ Completes the SRS by adding appropriate content for each section of the template, based upon the effort's requirements and the Team's understanding of those requirements; and ✓ Conduct peer review(s) of the SRS with the appropriate stakeholders. ✓ Reviews and approves effort's requirements
Project Management Office (PMO)	✓ Provides documented policies for Requirements Management ✓ Offers RQM support and guidance for ITCD efforts including via available RQM tools, training and mentoring ✓ Reviews and approves efforts' requirements ✓ Escalates requirements-related concerns to RMO and/or Management/Senior Leadership, when appropriate ✓ Validates RQM artifacts ✓ Aggregates, measures, and analyzes ITCD RQM-related data and performance

Table 1: Requirements Management Stakeholders Roles & Responsibilities

Stakeholder Roles	Responsibilities
Responsible Management Official/Office (RMO)	✓ Secures spending authority and resources ✓ Is the effort's champion ✓ Participates in effort's planning and aids in the definition of scope and business requirements for the effort ✓ Approves the requirements prior to baselining ✓ Assists with major issues, problems, and policy conflicts ✓ Approves requirements changes ✓ Signs off on major deliverables
Management/Senior Leadership	✓ Conducts peer review of the System Requirements Specification (SRS) ✓ Provides requirements (and constraints) for the effort ✓ Approves the requirements prior to baselining
Customer(s)/Affected Stakeholders	✓ Provides requirements to the effort's Team ✓ Conducts peer review(s) of the System Requirements Specification (SRS) ✓ Signs off on Requirements documents, as authorized

** Requirements Manager or membership on an effort's Requirements Management Team are functional roles that may, or may not be, unique resources depending on effort's size, complexity, or constraints.*

2 RQM PROCESSES

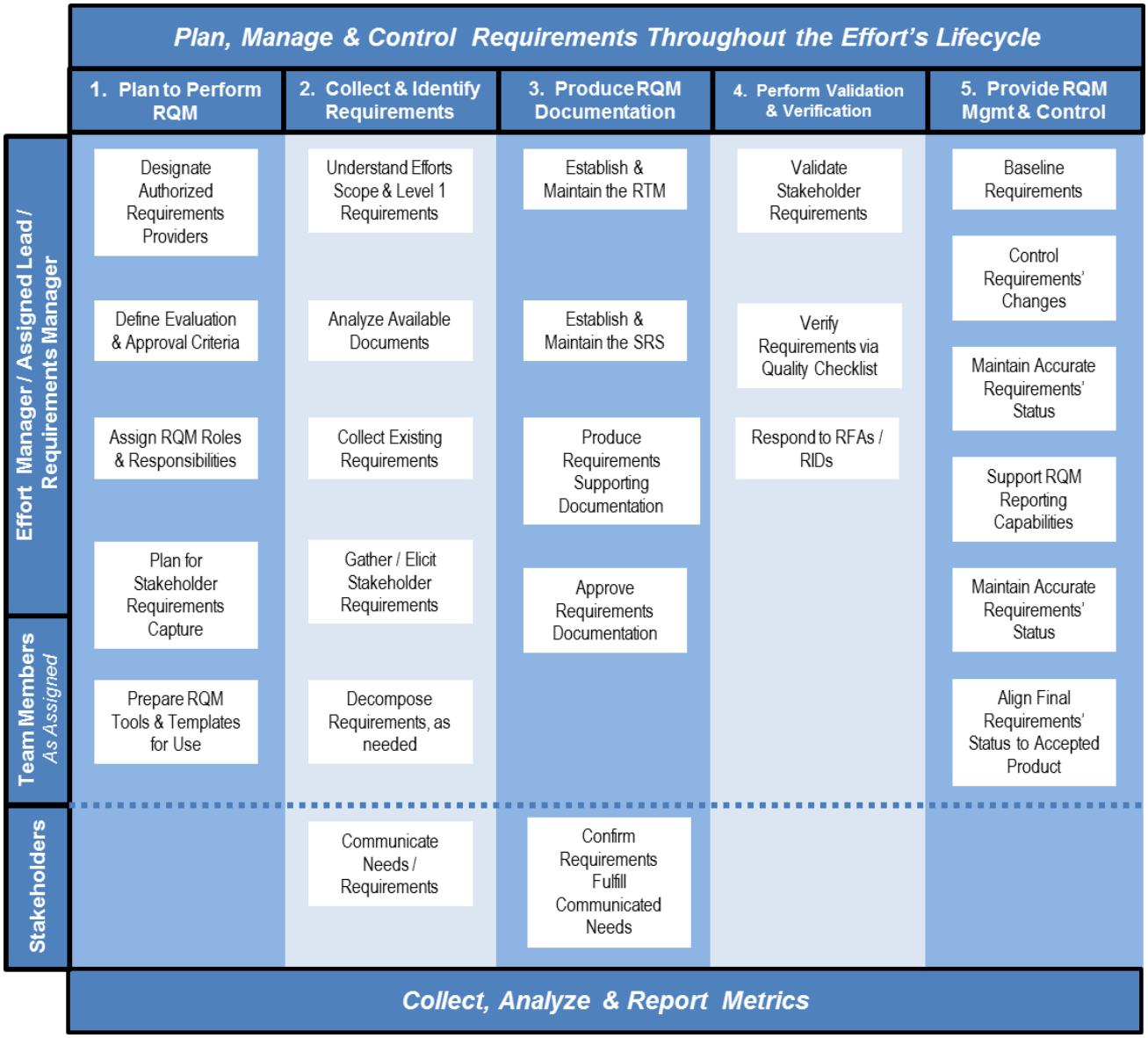


Figure 2: Overview of the RQM Processes & Related Activities

2.1 PLAN TO PERFORM REQUIREMENTS MANAGEMENT

2.1.1 Designate Authorized & Approved Requirements Providers

There are two things that RQM must define for the effort during the early planning stages to lay the foundation for successful requirements management:

- "Who" can create, define, or change requirements of the effort, system, solution, product, or service; and,
- "What" the criteria for evaluation and acceptance of requirements are.

In addition to being designated by the Requirements Manager, each requirement provider must be approved and authorized by the Customer, Project, or Organization to provide requirements, and should also be:

- Knowledgeable of the project scope (and constraints)
- Knowledgeable of the type of requirements for which they are responsible
- Available to the project for consultation, review, and approval

2.1.2 Define Requirements Evaluation & Approval Criteria

Requirements Management Planning involves defining the general evaluation and acceptance criteria for the effort's deliverables, system, solution, product, or service.

Requirements management planning also encompasses identifying all stakeholder groups authorized and approved to provide requirements to the project, defining the requirements verification, validation and approval process, identifying tools that will be utilized, and listing the deliverables that will be produced and maintained throughout the requirements management lifecycle.

2.1.3 Assign RQM Roles and Responsibilities

The effort's program or project manager (or assigned lead) shall assign RQM roles and responsibilities to designated Team Members.

2.1.4 Prepare RQM Tools & Templates for Use

ITCD efforts shall use a bidirectional Requirements Traceability Matrix (RTM) to manage requirements throughout the lifecycle of the effort.

An RTM template has been established for ITCD use and tailoring. Additional details regarding RTM data requirements are provided within ***Appendix B – RTM Data Requirements***.

The effort's program or project manager, assigned lead, or requirements manager shall prepare the necessary RQM tools and templates to ensure that each is available for use.

The following tools shall be used to document and manage requirements throughout the effort's lifecycle:

- Requirements Traceability Matrix (RTM)
- System Requirements Specification (SRS)
- Formal Requirements Review Presentation Template

There are established templates for these and other RQM activities that are available for ITCD efforts' use and tailoring.

2.1.5 Plan for the Capture of Stakeholders' Requirements

ITCD efforts shall plan for the collection and documentation of requirements from its identified stakeholders.

Requirements may be captured using any of the following approaches:

- Interviews
- Observations or expert judgment
- Focus or Working Groups
- Facilitated Workshops
- Collaborative Group Sessions involving affinity diagramming, idea/mind mapping, or brainstorming
- Group Decisional Analysis and/or voting techniques
- Questionnaires or surveys
- Prototypes, use cases, or storyboards
- Benchmarking
- Drawings or diagrams
- Analysis, comparison, or evaluation

The ITCD effort's program or project manager, assigned lead, or requirements manager shall identify the appropriate method(s) to be used to elicit and capture requirements from the appropriate stakeholders.

ITCD efforts shall reflect the planned requirements capture activities in the effort's schedule, including the estimated time and resources necessary to complete those activities.

Table 2: Planning for Stakeholder Requirements Capture

Tasks	Purpose	Inputs	Output
Prepare for Capturing Stakeholder Requirements	Ensure all needed resources are organized and scheduled for conducting the requirements capture activities, using the method(s) selected	• Defined Business Problem • Requirements capture method selected • Supporting materials • Stakeholder list • Stakeholder roles and responsibilities	• Scheduled activities and resources

2.2 COLLECT & IDENTIFY REQUIREMENTS

2.2.1 Understand the Effort's Requirements & Scope

ITCD organizations, services, activities, programs and/or projects shall collect, identify, and document each effort's requirements.

ITCD efforts' requirements to be documented include business and management requirements and technical and solution-oriented requirements.

Business & Management Requirements. ITCD efforts shall be able to describe through documentation and demonstration those business and management requirements including but not limited to:

- Business and effort objectives for traceability;
- Business rules for the performing organization;
- Guiding principles of the organization;
- Budget/funding requirements;
- Stakeholder communication and reporting requirements;
- Staffing and other resource requirements;
- Duration requirements;
- Acceptance criteria requirements;
- Implementation or transition requirements;
- User Support and training requirements;
- Levels of service, performance, safety, compliance, etc.;
- Impacts to other organizational areas;
- Impacts to other entities inside or outside the performing organization; and
- Any requirements' assumptions, dependencies, or constraints.

Technical & Solution-Oriented Requirements. ITCD efforts shall be able to describe through documentation and demonstration those technical and solution-oriented requirements including but not limited to:

- Functional and non-functional requirements for the system, solution, product, or service;
- Security and privacy requirements;
- Interface and integration requirements;
- Performance and quality requirements;
- Operability, reliability, and maintainability requirements;
- Design constraints;
- Applicable reporting or other output requirements; and
- Technology and standards compliance requirements.

2.2.2 Analyze Documents & Collect Existing Requirements

Existing documentation shall be analyzed to identify and collect requirements for ITCD efforts.

ITCD efforts will use available relevant documentation, including (but not limited to) the following documentation as potential sources for requirements collection:

- Formal Plans including Strategic and Tactical Plans for ITCD;
- IT Investment Business Case and other Capital Planning and Investment Control (CPIC) artifacts;
- Effort authorization documentation such as: Charter, Formulation Authorization Document (FAD), or Scope Documents;
- Formal agreements that affect the effort, including but not limited to:
    - Final responses to Requests for Proposals Requests for Quote (RFP/RFQs), etc.
    - Statement of Work (SOW),
    - Statement of Objectives (SOO),
    - Performance Work Statements (PWS), and
    - Memorandum of Understanding (MOUs);
- Project Management Plan/Project Plan (PMP or PP) and applicable supporting management plans (e.g., stakeholder management plan, risk management plan, configuration management plan, etc.);
- Existing process flows, procedures, logical data models, design or operational documentation;
- Standards, technical guides, and handbooks;

- Compliance or regulatory documentation; or
- Training materials.

2.2.3 Gather Stakeholders' Requirements

ITCD efforts shall conduct the planned and scheduled activities for the capture or elicitation of stakeholders' requirements.

The process for requirements gathering involves preparing for the capture or elicitation of stakeholders' requirements, conducting the capture or elicitation session(s) using the selected approach(es), documenting the results, and then confirming the results with the relevant stakeholders.

The table that follows depicts the typical requirements capture process with tasks, inputs, and outputs.

Table 3: Requirements Management Elicitation Process

Tasks	Purpose	Inputs	Output
Conduct Requirements Capture Session	Meet with stakeholder(s) to elicit information regarding their needs, using the method selected	• Charter, Scope, or other sources for the effort's high-level requirements • Defined Business Problem or need • Organizational Standards • Supporting materials	• Elicitation activity results • Assumptions, constraints, risks, issues • Documentation based on technique (e.g., interview notes, workshop results, survey responses, etc.)
Document Results	Record the information provided by stakeholders for use in analysis	• Results from requirements capture activity/activities	• Documented requirements
Confirm Results with Relevant Stakeholders	Validate that the stakeholder's intentions have been correctly captured and understood	• Documented requirements	• Confirmed and documented requirements

Detailed requirements shall be elicited to ensure that the ITCD effort's system, solution, product, or service developed will meet the needs of the impacted stakeholders and deliver upon the confirmed requirements.

ITCD effort's requirements shall:

- Be linked to the effort's high level requirements (as identified in the Charter, Scope document, FAD, Business Case, or other authorizing documentation)
- Define functions (features, capabilities) that the system, solution, product, or service is expected to perform;
- Document any design constraints that are imposed (i.e., must use a specific COTS product);
- Establish mandatory security and privacy requirements;
- Define performance expectations (e.g., 2 second response rate);
- Define the reliability expectations of the system, solution, product, or service (e.g., expected availability, reliability and maintainability metrics or service level agreements, disaster recovery including: failover, backup, etc.);
- Define supportability, including operations and maintenance needs (e.g., required support tools, coding standards, etc.);
- Address applicable accessibility and usability requirements (e.g., Section 508 and other applicable standards);

In addition, ITCD efforts' requirements shall:

- Meet characteristics to include: Specific, Measurable, Attainable, Realizable, and Traceable ("SMART").
- Are bi-directionally traceable to the effort's objectives, design/implementation, and test cases;
- Are testable/verifiable; and,
- Are understood and accepted by all relevant stakeholders.

2.2.4 Decompose Requirements

ITCD effort's requirements will be decomposed, as needed, to establish an appropriate level of detail and understanding for each requirement, and so that each requirement meets the general criteria in the table that follows.

Table 4: Decomposed Requirement Characteristics

General Criterion	Definition
Correct	The requirements are correct if every documented requirement represents or is derived from the scope, business need or associated Customer requirements in the effort's formal agreement(s) or elsewhere.

Table 4: Decomposed Requirement Characteristics

General Criterion	Definition
Unambiguous	The requirements are *unambiguous* if there is one reasonable interpretation of each documented requirement and are commonly understood by all affected groups (e.g., Customer, developer, manager, tester, standards, compliance).
Complete	The requirements are *complete* if the scope, business need, and associated Customer requirements are addressed by the documented requirements.
Consistent	The requirements are *internally consistent* if no documented requirement conflicts with another documented requirement.
Ranked / Prioritized	The requirements are *ranked or prioritized* if each requirement is arranged or listed in order of priority or importance, and/or assigned a value that designates its value against a designated set of criteria.
Verifiable	The requirements are *verifiable* if for each documented requirement there is a reasonable procedure for determining whether the system, solution, product, or service (to be developed) satisfies that requirement.
Modifiable / Modular	The requirements are *modifiable or modular* if it is organized so that changes can be made easily. Modifiable requirements are carefully indexed and cross-referenced, and do not include redundant requirements.
Traceable	The requirements are *traceable* if they are organized such that the documented requirements can easily be related to one another and can be effectively linked to a design element and test specification.

2.3 PRODUCE AND MAINTAIN RQM DOCUMENTATION

Requirement documentation must be able to communicate the requirements of the Customer to the effort's program or project manager, assigned lead, and team members, and other stakeholders, and must be presented in a way that is easily understood by the effort's identified stakeholder groups.

ITCD efforts' requirement documentation presentation and content should be constructed in a way which can be either expanded upon or collapsed to meet the varying informational needs of Customers, senior management and leadership, and other identified stakeholder groups.

2.3.1 Establish and Maintain the RTM

ITCD efforts shall produce and maintain a Requirements Traceability Matrix (RTM).

The effort's RTM will establish a linkage from the source requirements through its decomposition to implementation and verification.

Additionally, the RTM shall establish the priority and category of the requirement along with its impact to other requirements and configured items.

The effort's RTM will show bidirectional traceability of:

Requirement ←→ Decomposed Requirement ←→ Design ←→Test ←→Product Release

2.3.2 Establish and Maintain the SRS

The ***System Requirements Specification*** (SRS) shall be used to establish a link between the system requirements and all its dependencies.

The SRS will contain all nonfunctional requirements, design constraints, and other factors necessary to provide a complete and comprehensive description of the requirements for the system, solution, product, or service.

The SRS should be written after the requirements gathered have been documented and analyzed in an RTM.

A SRS should at a minimum address the following:

- Define the functions of the Solution
- Define the Hardware / Software Functions
- Define the Performance Specifications
- Define the Hardware / Software Performance
- Define Reliability and Accessibility
- Define Safety Requirements
- Define the Security and Privacy Requirements
- Define the User Interface
- Describe System Interface(s), including Interface Control Drawings (ICD's)
- Describe Reporting, or other Output Requirements,
- Describe Business Rules, Processing Algorithms, or other Solution-specific standards to be used
- Provide Installation Drawings/Instructions
- Provide Operations or Maintenance Requirements

The purpose and benefits of a completed SRS include:

- Establishes the basis for agreement between the stakeholders and the project team on what the effort's product or service is supposed to do
- Reduces the development effort (prevents rework)
- Provides a basis for estimating costs and schedules
- Provides a baseline for validation and verification

- Serves as a baseline for future changes or enhancements

2.4 PERFORM VALIDATION & VERIFICATION ACTIVITIES

Validation and verification activities occur at different points of the effort's lifecycle.

Early in an effort's lifecycle, the requirements review validates that requirements are correct as defined, state the intended need, are complete and accurate, meet all pertinent standards, and have the support of designated requirements providers and relevant stakeholder groups.

Midway through an effort's lifecycle, requirements and product validation and verification occurs to ensure that all the approved requirements are accurately reflected in the product's design and test cases.

Towards the end of the effort's lifecycle, the final product is verified and validated for conformance to the approved requirements; ultimate verification and validation of an effort's requirements comes with the acceptance of the finished product.

Activities used to validate and verify documented requirements are critical success factors for ITCD efforts' design, development, and implementation of their requirements and include:

- Formal Reviews (i.e., to obtain requirement acceptance and approval)
- Prototypes or Demonstrations (i.e., to verify that requirements, design, or product reflect requirements as-intended)
- Testing and Acceptance Activities (i.e., to verify that final product conforms to the final baseline of approved requirements)

ITCD efforts shall plan and execute appropriate validation and verification activities.

ITCD efforts shall reflect validation and verification activities within the effort's schedule to include estimates for the time and resources planned for the performance of those activities.

2.4.1 Validate Requirements with the Stakeholders

Review of requirements is an iterative process to review and validate the requirements gathered and decomposed in the RTM and SRS documents, and helps to ensure those documented requirements reflect the stated needs of the stakeholders.

The process of validation is essential to the success of the effort, and prevents identification of missing, unclear, ambiguous, or conflicting requirements and helps to ensure that the requirements meet certain quality characteristics, as well as stakeholder needs.

ITCD efforts' requirements must be verified, validated, and approved prior to design. Failure to do so will inevitably lead to missing or invalid requirements being discovered when it is too late or too costly

to address them, will create unplanned rework, and result in schedule slippages and possible cost overruns. When this occurs, efforts will likely experience reprioritization or descoping of requirements to minimize these adverse affects.

ITCD efforts shall verify and validate the effort's requirements are accurate and complete by conducting a formal requirements review, and by addressing all approved changes from designated requirements providers, and gaining approval of the documented requirements from the relevant stakeholders.

ITCD shall use three key questions to assess and validate requirements:

1. **Are Requirements Written Correctly?** Review requirements for appropriate "shall" statement format; correct any syntax, spelling, grammar, punctuation, or other editorial errors;

2. **Are Requirements Technically Correct?** Engage appropriate subject matter experts to identify and remove as many technical errors as possible before having all the relevant stakeholders review the requirements. Check that the requirement statements have bidirectional traceability to the baselined stakeholder expectations, and are essential to, and consistent with, designing and realizing the appropriate solution; and

3. **Do the Requirements Satisfy the Stated Needs?** Oversee authorized requirement providers' review of the requirements; engage stakeholders to identify errors within their requirements, to resolve any requirement conflicts, and to provide necessary clarifications to ensure accuracy and remove ambiguity of their stated requirement(s).

The RMO, affected organizations, and representation from relevant stakeholder groups shall be included in the review decision to approve and accept the requirements as documented.

At the conclusion of the formal requirements review, a documented decision will be made whether to: accept/reject the proposed requirements as-is, to conditionally approve pending the completion of any documented Requests For Action (RFAs) or Review Item Discrepancies (RIDs) from the review, or to approve the requirements and proceed with design, development, and implementation of those requirements for the effort's system, solution, product, or service.

ITCD efforts shall document and distribute meeting minutes from the review session(s), including decisions made regarding the acceptability of the requirements to the relevant stakeholders, and any outstanding RFAs and RIDs.

ITCD efforts shall address documented action items to the satisfaction of the designated stakeholders in a timely manner to secure final approvals prior to the Systems Requirements Review (SRR).

Once the requirements are approved, requirements shall be baselined and be placed under configuration management and control.

2.4.2 Verify and Validate Traceability using RTM

Verification is the process of inspecting the quality of the documented requirements in preparation for approval. ITCD efforts may use a Requirements Checklist to inspect and verify the quality of the requirements that have been gathered and documented; a sample checklist has been provided in ***Appendix C – Requirements Quality Checklist*.**

ITCD efforts shall verify and validate that requirements are traceable from design through to final approved product; a completed RTM shall be used for this purpose.

2.5 PROVIDE MANAGEMENT & CONTROL

The Requirements Management process is only useful if it recognizes and addresses the ongoing issue of change throughout an effort's full lifecycle. Managing change to the whole of an effort's requirements or to any of the individual requirements should be handled in a consistent way so that the effort:

- Automatically communicates its intent to make a requirements change;
- Enables the analysis of the impact that might result from implementing the proposed change;
- Controls the acceptance or approval of that change;
- Tracks the actual changes made, and
- Communicates the approved change to all impacted or interested stakeholders.

ITCD efforts shall use CM practices established in the CM PG to ensure appropriate management controls are in place for requesting, approving, and controlling changes to requirements.

2.5.1 Baseline the Requirements

Once all the initial requirements management artifacts have been completed, they are baselined, and placed under configuration management to be maintained as a Configuration Items (CI) throughout the effort's lifecycle.

ITCD efforts shall baseline the approved requirements, control changes to those requirements, and maintain current and accurate statuses of all documented requirements for the effort, rebaselining as needed.

2.5.2 Control Changes to Requirements

After each level of requirements is accepted and baselined, any change to the requirements and related work products will be restricted and will only be made through the change request process defined by the effort's Configuration Management Plan (CMP) or ITCD's Configuration Management Procedures and Guidelines (CM PG), whichever is applicable.

ITCD efforts shall implement only approved requirement changes.

2.5.3 Maintain Requirements Status

Throughout the lifecycle of the requirements process, requirements statuses shall be kept up to date in the RTM. Requirements statuses include:

- Approved
- Rejected
- Deferred or Planned for Future Release, and
- Implemented (include Release and Date information).

2.5.4 Provide RQM Status Reporting Capability

Throughout the lifecycle of managing ITCD efforts, regular status reporting is required. The ***Project Status Reviews (PSR***) and ***Directorate Status Reviews (DSR***) are two forums that shall fulfill organizational status reporting requirements.

Metrics gathered on the requirements management process may be presented as part of status reporting.

Key metrics for RQM status reporting include, but are not be limited to:

- Number of original requirements;
- Current status of each requirement (i.e., approved, rejected, deleted, on hold, planned for future release, etc.);
- Number of requirements added to date; and
- Degree of compliance to approved requirements;
- Impact of modified and/or new requirements;
- Percentage of requirements changed to date.

2.6 ALIGN FINAL REQUIREMENTS STATUS TO PRODUCT ACCEPTANCE

Prior to accepting and implementing the effort's final system, solution, product, or service, ITCD efforts shall verify requirements in the final solution against the approved RTM and SRS documents, and baselined requirements to ensure all requirements have been addressed in the final system, solution, product, or service that was produced and presented for acceptance.

Any Priority 1 approved requirement that *is not* demonstrated in evidence in the final system, solution, product, or service that was presented for acceptance must be noted as a discrepancy, and may be required to be resolved or dispositioned to the satisfaction of the designated requirements providers and to the RMO and other appropriate stakeholders to receive final product acceptance.

ITCD efforts shall update and align final requirements documentation to reflect actual implementation status of each requirement (i.e., implemented, or not, and in what release, etc.), based on final product accepted and released.

3 RQM TOOLS

The following tools shall be used by ITCD to manage requirements throughout the full lifecycle of the effort:

- Requirements Traceability Matrix (RTM)
- System Requirements Specification (SRS) document
- System Requirements Review process and related artifacts
- Appropriate reporting tools and formats for ITCD reporting forums

ITCD organizations, programs or project managers, assigned leads, and team members shall use a RTM tool that meets all the data requirements specified within ***Appendix B – RTM Data Requirements***.

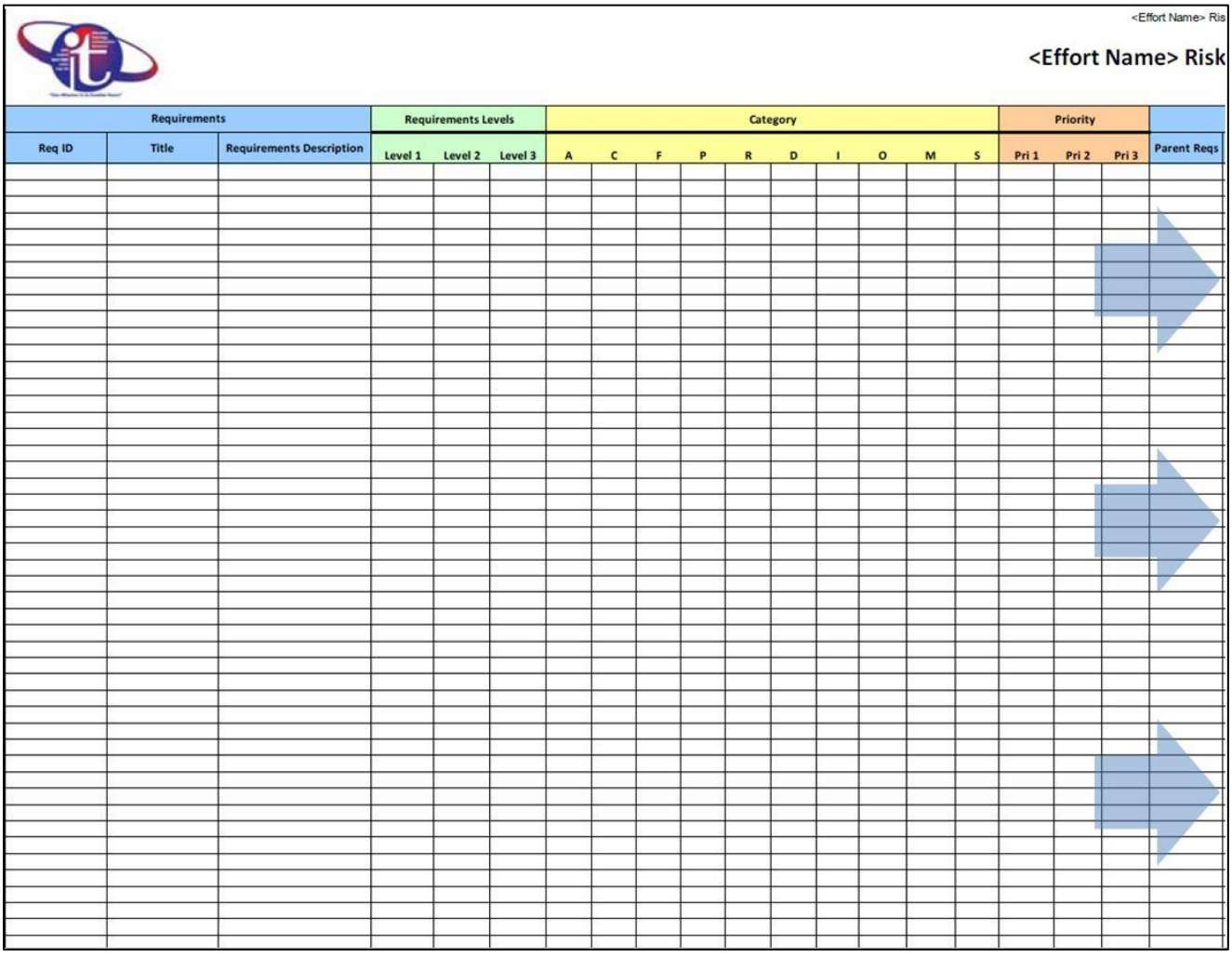
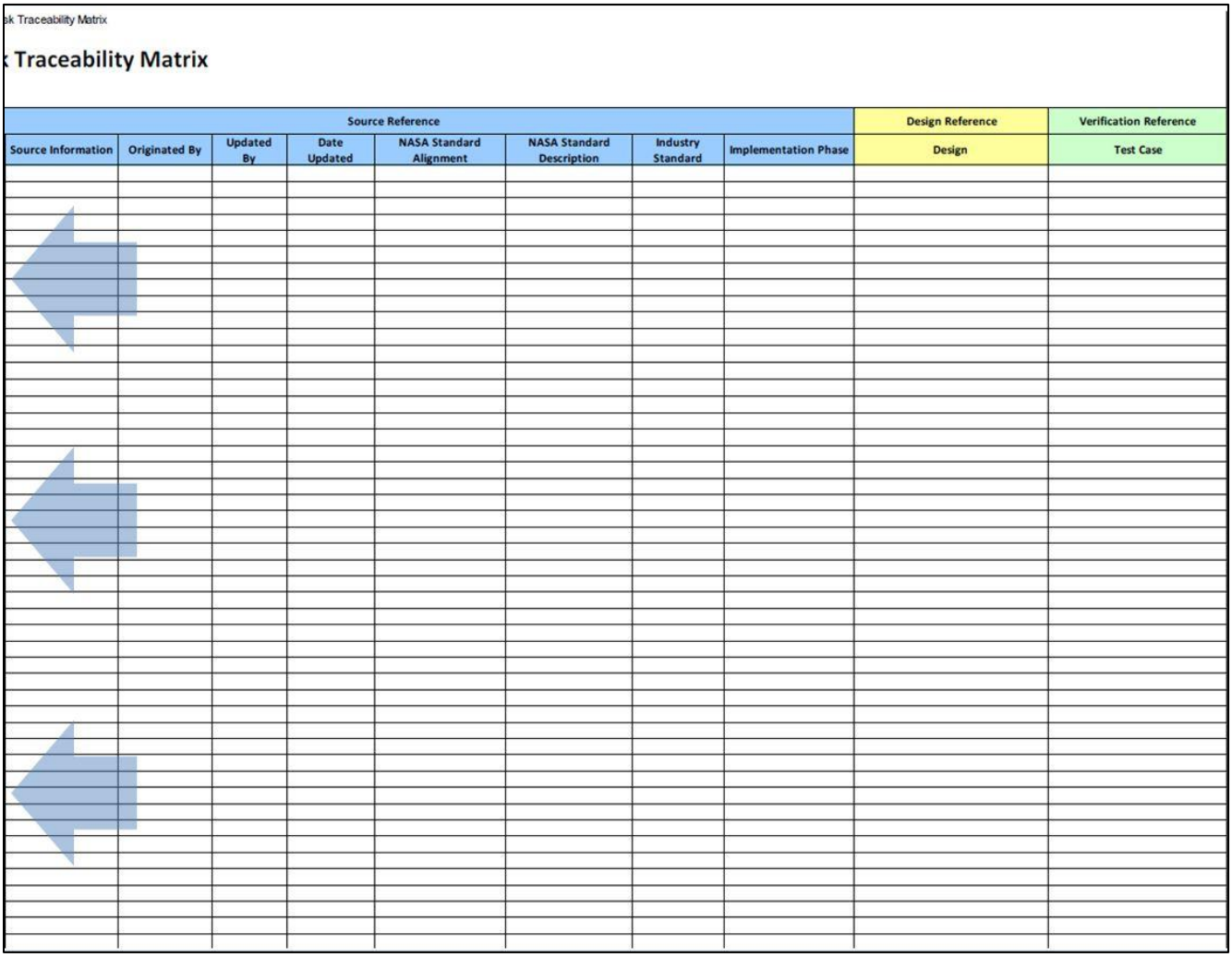


Figure 3: Sample ITCD RTM (Left Side)


sk Traceability Matrix

k Traceability Matrix

Source Reference								Design Reference	Verification Reference
Source Information	Originated By	Updated By	Date Updated	NASA Standard Alignment	NASA Standard Description	Industry Standard	Implementation Phase	Design	Test Case

Figure 4: Sample ITCD RTM (Right Side)

ITCD organizations, programs or project managers, assigned leads, and team members may use the available PMO-approved tools and templates, including the Requirements Quality Checklist provided in Appendix C, to capture, document, and verify an effort's requirements.

APPENDIX A – TERMS, DEFINITIONS & ACRONYM LISTS

Terms & Definitions

A.1 **Bidirectional Traceability –** Needs to be implemented both forward and backward (i.e., from requirements to end products and from end product back to requirements). When the requirements are managed well, bidirectional traceability can be established from the source requirement to its lower level requirements and from the lower level requirements back to their source. This helps determine that all source requirements have been completely addressed and that all lower level requirements can be traced to a valid source.

A.2 **Complete –** The scope, business need, and all Customer Statement of Work requirements are addressed by the documented requirements.

A.3 **Consistent –**No documented requirement conflicts with another documented requirement.

A.4 **Correct –** Every documented requirement represents or is derived from the scope, business need, or Customer requirement contained in the contract Statement of Work or elsewhere.

A.5 **Modifiable/Modular –** Requirements are organized so that changes can be made easily, carefully indexed and cross-referenced, and do not include redundant requirements.

A.6 **Prioritized/Ranked –** Requirement is arranged or listed in order of priority or importance, or assigned a value that designates its value against a designated set of criteria.

A.7 **Requirement Prioritization –** Used to determine which candidate requirements of a product should be included in a certain release. Requirements are also prioritized to minimize risk during development so that the most important or high risk requirements are implemented first.

A.8 **Requirements Collection and Identification –** The process to determine, document, and manage stakeholder needs and requirements to meet the effort's objectives.

A.9 **Requirements Documentation & Approval –** The process to collect and/or create and document a set of requirements that is understood by the effort's stakeholder groups, and approved by the relevant authorized parties.

A.10 **Requirements Management & Control –** The process to oversee and management the change of requirements**.**

A.11 **Requirements Management –** Discipline that defines how requirements will be analyzed, documented, and managed.

A.12 **Requirements Management Planning –** The process to define how requirements-related activities will be planned, tracked, and monitored.

A.13 Requirements Validation & Verification – The process to ensure the requirements are meeting the intended need, have been fully addressed in design and development, meet all pertinent standards, and have the support of the stakeholders.

A.14 System Requirement Review – Is the process to review and make decisions about requirements gathered and decomposed in the RTM and SRS documents to ensure the documented requirements reflect the current needs of the of the business and stakeholders

A.15 System Requirements Specification – Used to establish a link between the system requirements and all its dependencies. The SRS contains all nonfunctional requirements, design constraints, and other factors necessary to provide a complete and comprehensive description of the requirements for the solution (product or service).

A.16 Traceable – The requirements are organized such that the documented requirements can be effectively referenced to one another and by design element and test specification.

A.17 Unambiguous – There is one reasonable interpretation of each documented requirement and it is commonly understood by all stakeholders.

A.18 Verifiable – Each documented requirement has a reasonable procedure for determining whether the product or service (to be developed) satisfies that requirement.

Acronym List

Acronym / Term	Definition
APPEL	Academy of Program/Project and Engineering Leadership
BABOK	Business Analysis Body of Knowledge
CI	Configuration Items
CM	Configuration Management
CMMI	Capability Maturity Model Integration
CMP	Configuration Management Plan
COTS	Commercial off-the-shelf
CPIC	Capital Planning and Investment Control
DIT	Development and Integration Testing
DSR	Directorate Status Review
FAD	Formulation Authorization Document
GDMS	Goddard's Directive Management System
GPR	Goddard Procedural Requirement
GSFC	Goddard Space Flight Center
HPP	High Priority Practice
HVAC	Heating Ventilation and Cooling
ICAM	Identity Credential and Authorization Access Management
IIBA	International Institute of Business Analysis
IT	Information Technology
ITAR	International Traffic and Arms Regulation
ITCD	IT & Communications Directorate (Code 700)
MOU	Memorandum of Understanding
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
NASA	National Aeronautics and Space Administration
NPR	NASA Procedural Requirement
PG	Procedures and Guidelines
PII	Personally Identifiable Information

Acronym / Term	Definition
PIMD	Program Integration & Management Division (Code 740)
PM	Project Management / Program Manager
PMBOK	Project Management Book of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
PMP	Project Management Plan
PP	Project Plan
PSR	Project Status Review
PWS	Performance Work Statement
RFP	Request for Proposal
RFQ	Request for Quote
RMO	Responsible Management Official
RQM	Requirements Management
RQM PG	Requirements Management Procedures and Guidelines
RQMP	Requirements Management Plan
RQT HPP	Requirements High Priority Practice
RTM	Requirements Traceability Matrix
RTS	Restore to Service
SAT	System Acceptance Testing
SATERN	System for Administration, Training and Educational Resources
SBU	Sensitive but Unclassified
SCR	System Concept Review
SEI	Software Engineering Institute
SMART	Specific Measureable Attainable Realizable and Traceable
SOO	Statement of Objectives
SOW	Statement of Work
SRR	System Requirements Review
SRS	System Requirements Specification
STK	Stakeholder Management

Acronym / Term	Definition
TBD	To Be Determined
UAT	User Acceptance Testing

APPENDIX B – RTM DATA REQUIREMENTS

ITCD RTMs shall comply with the following data requirements, at a minimum:

Data Required	Description	Format / Explanation
Requirement Identifier	A unique ID for the requirement that follows a consistent numbering schema	Each number assigned must result in a unique ID for each requirement. A unique ID should not be reused, even if the requirement / item is deleted and removed from the project scope IDs should not be renumbered to incorporate a change IDs are of course flexible while drafting requirements, but it is vital that they are not altered once the document has been issued for either sign off or where we issue a draft to a developer / test to allow them to produce an estimate of their work. This ensures that if they have referred to the IDs in their work that they do not have to change anything as a result of a change following a review or a formal change request. An example numbering scheme is as follows 1.0 – Parent Requirement 1.1, 1.2, 1.3 – Child Requirements to the Parent 1.1.1, 1.2.1, 1.3.1 – Sub-requirements to the Child
Requirements Title	A unique title for the requirement	Each requirement must have a unique title

Data Required	Description	Format / Explanation
Requirement Description	Textual description of the requirement	The use of one of the following terms is required within each requirement statement: ***Shall:*** Denotes a requirement ***Should:*** Denotes a good practice ***May or Can:*** Denotes permission ***Will:*** Denotes an expectation ***Is:*** Denotes descriptive material *(As derived from NPR 7120.7)*
Requirement Level Classification	Maps the requirement to the appropriate classification type and level of the requirement.	Options include: Levels 1, 2, 3 … etc. **Level I: Authoritative Requirements:** Top level requirements which drive the scope and direction of a Project Project drivers/goals; the reasons for undertaking the Project May include policy, governance, and applicable standards Typically incorporated into the Scope Document **Level II: Architecture-Platform Requirements:** Address the environment in which the proposed Project will function Project objectives that support the purpose and goals of the project **Level III: Component Requirements:** Address specific system, device and other hardware/software components that comprise the Project What is to be accomplished to meet the Project objectives Can be used to evaluate the adequacy of a Commercial Off-The-Shelf (COTS) solution

Data Required	Description	Format / Explanation
Source Information	Cites the source of the requirement	Referenced requirement sources may include (but are not limited to): Federal Regulations, NASA and Goddard policies or requirements, formal agreement or contract requirements, etc., and should identify the stakeholder source for requirements that were either elicited or decomposed.
Requirement Category	Maps the requirement to an appropriate category type that supports the grouping, sorting, and filtering of requirements by like category.	Requirements Categories include: • **Accessibility (A)** - Includes all requirements that address meeting Section 508. • **Capabilities (C)** - Defines what the proposed system, solution, product, or service will do or provide. • **Functions (F)** - Defines the primary tasks that the proposed system, solution, product, or service must perform. Include what is needed by the system, solution, product, or service's users, and required inputs/outputs. • **Performance Standards (P)** - Defines the required execution efficiency standards that are applicable to the system, solution, product, or service. This may include: How often and how well; to what accuracy; quality and quantity of the output(s); under what stress will the system/service/solution be expected to perform; for what duration; quality and quantity of outputs; range of values; tolerances; maximum throughput or bandwidth capacity.

Data Required	Description	Format / Explanation
		Performance requirements should be expressed as follows: 1. A threshold value (the minimum acceptable value needed for the system, solution, product, or service to perform its primary functions.) 2. The baseline level of performance desired. • **Reliability (R)** - Defines the required soundness standards that are applicable to the proposed system, solution, product, or service. Reliability requirements ensure that the system, solution, product, or service (and related sub-systems' hardware and software) can perform in the predicted environment and conditions throughout its lifecycle and has the ability to withstand certain numbers and types of faults, errors or failures. Reliability requirements address design and verification requirements to meet the requested level of operation, and cover fault/failure prevention, detection, isolation, and recovery. • **Design (D)** - Defines the requirements or constraints that are applicable to the architecture of the system, solution, product, or service. Design requirements control the design of the proposed system, solution, product, or service throughout the engineering design process, and may include hardware and software parameters, maintainability, availability, and testability.

Data Required	Description	Format / Explanation
		• **Interfaces (I)** - Identifies both the internal/external (logical and physical) where joining together occurs that will be supported by the system, solution, product, or service. Internal/external is in reference to the system, solution, product, or service as established by the security plan the system, solution, product, or service falls under. • **Operations (O)** - Defines the requirements that are applicable to the day-to-day activities of the operational environment. Operational requirements may include: adherence to applicable standards, policies and controls; metrics reporting and compliance such as Service Level Agreements (SLAs), availability metrics, and Restore To Service (RTS) parameters • **Manageability (M)** - Defines the requirements that are applicable to the oversight and control of the system, solution, product, or service. Manageability may include one or more of the following: hardware inventory; availability monitoring and metrics; software inventory and installation; anti-virus/anti-malware management; user activity monitoring; capacity monitoring; security management; storage management; network capacity and utilization monitoring; anti-manipulation management. • **Security** (S) - Lists requirements applicable to assuring the safety of the system, solution, product, or

Data Required	Description	Format / Explanation
		service, including: identity, credential, and authorization and access management (ICAM) requirements, security policy and regulation requirements, privacy and sensitivity requirements (i.e., International Traffic in Arms Regulations (ITAR), Sensitive But Unclassified (SBU), Classified, etc.), and others.
Requirement Priority	Defines the prioritization of the requirement in relation to other requirements and their implementation	Options include Priority 1, 2, 3…etc. where: **1: High** (must be implemented) **2: Medium** (not mandatory, but should be implemented) **3: Low** (may be deferred for a future release)
Requirement Status	Identifies the current status of an individual requirement within a baseline set of requirements	Statuses include: **Approved** **Rejected** **Deferred** or **Planned for Future Release**, and **Implemented** (include Release and Date specifics)
Traceability Mapping	Identifies bidirectional traceability of the requirement from the requirement source to its design, test, and implementation.	Varied – Depicts reference to design and/or test ID in documentation, including but not limited to: design and test specifications and implemented component, capability or subsystem of the product or solution

APPENDIX C – REQUIREMENTS QUALITY CHECKLIST

The checklist that follows facilitates inspecting and validating requirements' quality.

Global Across Requirements Documentation:

- Is a functional overview of the system provided?
- Have the software and hardware environments been specified?
- Are implementation assumptions stated?
- Have the functionality of hardware or software interacting with the system been properly specified?
- Has every acronym been defined?
- Is each requirement date-stamped?
- Is each requirement traceable to its source?
- Is each requirement traceable to the GSFC strategic objective it addresses (if applicable)?
- Is a numbering scheme employed to facilitate traceability and control?
- Are relationships among requirements clearly defined and organized to show how they may relate to form subsystems and a complete system?
- Are boundaries, scope, and context of the requirements identified?
- Is the document easily searchable for modification, and addition of requirements?
- Do the requirements avoid specifying design-level details?
- Are the requirements at a fairly consistent level of detail?
- Are the requirements clear enough to be turned over to an independent group for implementation and still be understood?
- Does the set of requirements adequately address all appropriate exception conditions?
- Can the requirements be implemented within known constraints?
- Are all cross-references to other requirements correct?
- Are all requirement levels (1-3) and categories contained within the requirements?
- Are all missing items or unresolved issues identified with a TBD, an owner, and a time-line for closing it?

Individual Requirements

- Is the requirement clear and concise?
- Is the requirement stated in as simple a form as possible?

- Is the requirement testable/verifiable?
- Is the requirement correct?
- Is the requirement in scope? (i.e., the system will be considered incomplete if even one requirement is left out)
- Is the requirement as modifiable as possible?
- Is the requirement written in the customer's language, using the customer's terminology?
- Is the requirement necessary?
- Does this requirement answer the question 'How Well'?
- Is each requirement implementation independent?
- Is there a priority assigned to the requirement?
- Is there a level assigned to the requirement?
- Is there a category assigned to the requirement?

Business and Functional Requirements:

- Are the high-level business objectives described?
- Are the requirements understandable by all stakeholders?
- Is the value to the business identified? (Cost savings, reduced inventory, etc.)
- Is the value to the customer identified? (New features, improved usability, etc.)
- Does this requirement answer the question 'Why is this needed'?
- Does the set of functional requirements meet the needs outlined by business requirements? (e.g., complete, sufficient, etc.)
- Is the relation between functional and the non-functional requirements clear?

Interface Requirements

- Are all inputs to the system specified, including their source, accuracy, range of values, parameters and frequency?
- Are all outputs from the system specified, including their destination, accuracy, range of values, parameters and format?
- Are all screen formats specified?
- Are all report formats specified?
- Are all interface requirements between hardware, software, personnel, and procedures included?
- Are all communication interfaces specified, including handshaking, error-checking, and communication protocols?

Technical Requirements

- Are all inputs to a function sufficient to perform the required function?
- Are undesired events/inputs considered and their required responses specified?
- Have the types, initial values, units been defined for every object attribute?
- Have the parameter and return types of all object operations been defined?
- Have the accuracy, precision, range, type, rate, units, frequency of inputs and outputs been specified for each function?
- Is the expected response time, from the user's point of view, specified for all operations?
- Is the level of security specified?
- Is the reliability specified, including the consequences of software failure, the vital information that needs to be protected from failure, and the strategy for error detection and recovery?
- Is the maximum memory specified?
- Is the maximum storage specified?

System Requirements:

- Safety/Security
    - Are the security requirements specified?
    - Are the safety requirements specified?
- Performance
    - Are the response time or latency requirements specified?
    - Are the throughput requirements specified?
    - Are the data volume requirements specified? (input, stored, output)
    - Are the peak or short-term load requirements specified?
- Usability
    - Are the usability requirements specified?
    - Are the internationalization/localization requirements specified?
    - Are the look and feel requirements specified? (e.g., color schemes, standards, etc.)
    - Are business rules or standards documented? (e.g., formulas, algorithms, acceptable responses, or exceptions, etc.)
- Reliability
    - Are the availability (up time) requirements specified?

  - Are the reliability (e.g., Mean Time Between Failures (MTBF)) requirements specified?
  - Are the serviceability (e.g., Mean Time To Repair (MTTR)) requirements specified?
  - Are the robustness requirements specified?
- Accessibility
  - Do the interface functions support assess using assistive technology?
  - Are functions available in clear text for a user requiring assistive technology?
- Operational
  - Are all operational constraints or requirements specified? (e.g., network limitations, memory limitations, processor speed, Heating Ventilation and Cooling (HVAC), etc.)
  - Is scalability or anticipated growth requirements specified?
- Configuration
  - Are the supported and/or excluded configurations specified?
  - Are the compatibility requirements specified? (backwards/forwards across versions or other applications, etc.)

CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	01/23/14	Initial Release